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Environmental Restoration Project
Standard Operating Procedure

for:

Sampling for Volatile Organic Compounds in Groundwater

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Standard Operating Procedure Title

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Sampling for Volatile Organic Compounds in Groundwater

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the collection of groundwater samples from monitoring/characterization wells for analysis of volatile organic compounds (VOCs), and the selection of equipment and materials to be used in this process on the Envrionmental Restortion (ER) Project.

2.0 SCOPE

This SOP is a manadatory document and shall be implemented by all ER Project participants when sampling for volatile organic compounds in groundwater for the ER Project.

Note: Subcontractors performing work under the ER Project's quality program may follow this standard operating procedure (SOP) for sampling for volatile organic compounds in groundwater or may use their own procedure(s) as long as the substitute meets the requirements prescribed by the ER Project Quality Management Plan, and is approved by the ER Project's Quality Program Project Leader (QPPL) before the commencement of the designated activities.

3.0 TRAINING

The **Field Team Leader** (FTL) is responsible for ensuring that field team members who collect VOC samples for the ER Project are trained in the operation and calibration of the field analytical equipment. In addition all field team members who use this procedure shall be familiar with the objectives of VOC sampling and must document that they have read and understand this procedure in accordance with QP-2.2.

4.0 DEFINITIONS

4.1 *Site-Specific Health and Safety Plan (SSHASP)*—A health and safety plan that is specific to a site or ER Project-related field activity that has been approved by an ER Project health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

5.0 BACKGROUND AND PRECAUTIONS

5.1 This SOP shall be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on and use of all PPE.

5.2 Sample retrieval systems potentially suitable for the valid collection of volatile organic samples are reciprocating piston-type submersible pumps, gear-driven submersible pumps, syringe samplers, and bailers (Barcelona et al., 1984; Bennett, 1988; Nielsen et al., 1985; EPA, 1986; EPA Region 4, 1991). Field conditions and other considerations will limit the choice of system. The objective is to provide a valid sample for analysis, one that has been subjected to the least amount of turbulence and subsequent possible aeration.

5.3 Construction materials for pumps, bailers, and tubing are limited to stainless steel, Teflon, and glass. The tendency of organics to adsorb onto many materials makes the selection of sampling materials critical for these trace analyses. Plastics such as Tygon, for example, should be avoided.

5.4 There are numerous ways of introducing foreign contaminants into a sample, and these must be avoided by following strict sampling procedures and using only trained personnel.

5.5 For proper preservation and handling refer to SOP-1.02.

5.6 If floating organics are of concern (as determined by field measurement for floating organics), a representative sample cannot be confidently obtained.

5.7 The sensitivity of the analysis and the fragility of the samples require that a minimum of two containers (40 ml Teflon septum vials) should be employed for each VOC sample.

5.8 With proper preservation vials for volatile organic analysis (VOA) may be kept for up to 14 days when the samples are preserved with acid. The samples will be shipped to the Sample Management Office (SMO) daily or following each completed sampling effort. Sample shippers (coolers) will be sealed with custody seals. They must also be adequately packed and cooled to ensure that they arrive intact and within the acceptable temperature range. Refer to SOP-1.03 for further instructions.

5.9 Due to the short holding times, avoid collecting VOC samples before holidays or weekends. Samples submitted to the SMO after 2:30 p.m. will not be shipped until the following day.

6.0 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this procedure.

6.1 ER Project Personnel

6.2 Focus Area Leader

6.3 Quality Program Project Leader

6.5 Team Leader

7.0 EQUIPMENT

A checklist of suggested equipment and supplies required to implement this procedure is provided in Attachment A. Sampling mechanisms capable of obtaining samples for VOC analyses are described below.

7.1 *Reciprocating Piston-Type Submersible Pumps* — These systems are portable, self-contained, and capable of delivery flow rates of 30 gal./hr at lifts up to 500 ft. The pump fits into 2-in. wells, which is the most common monitoring-well diameter. The flow rate of the pump is varied by increasing or decreasing the driving pressure supplied to the pump from a compressed-air container. The gasoline that powers the pump does not contact the sample being purged.

7.2 *Gear-Driven Submersible Pumps* — These pumps provide comparable samples and are often easier to handle and cleaner than other pumps. More care, however, must be exercised when sampling with them because the flow rate is not controllable, and a greater potential for splashing and aeration of the sample exists.

7.3 *Syringe Samplers* — Only a limited number of commercial, syringe-type samplers are available (two vendors are IEA and TIMCO). These devices are limited in sample volume and are specifically for sampling volatiles. They operate with an evacuated chamber that is lowered down the well and allowed to fill because of the pressure of the water. The entire mechanism is brought to the surface with the sample. The sample can then be transferred to a sample vial, or, if preservation with chemical additives is not required, the entire unit may be sent as the sample container.

7.4 *Bailers* — The Teflon closed-top, bottom-charging type is the most appropriate bailer to collect water samples for volatile analysis. The bottom-emptying device with a tap is also desirable. Several vendors provide acceptable designs. Generally, bailers can collect a representative sample, provided that the sampling personnel use extra care in the collection process.

8.0 PROCEDURE

Note: ER Project participants may produce paper copies of this procedure printed from the controlled-document electronic file located at http://erinternal.lanl.gov/home_links/Library_proc.htm. However, it is their

responsibility to ensure that they trained to and utilize the current version of this procedure. The author may be contacted if text is unclear. Contact the Document Control Coordinator if the author cannot be located.

Note: Deviations from SOPs are made in accordance with QP-4.2, Standard Operating Procedure Development, and documented in accordance with QP-5.7, Notebook Documentation for Environmental Restoration Techncial Activities.

8.1 Pre-operation Activities

8.1.1 Assemble the equipment and supplies listed in Attachment A. Ensure that all equipment operates properly. If any equipment requires calibration, be sure to record this information on the Daily Activity Log form (Attachment E in SOP-1.04), the Water Quality Sampling Record (Attachment B in SOP-6.01), and the field notebook as specified in SOP-1.04.

8.1.2 Coordinate the sampling effort with the SMO. The SMO will give guidance in regard to sample containers, preservation, and shipment to the SMO.

8.1.3 Locate monitoring/characterization wells to be sampled and establish an appropriate decontamination area. Select the staging area and areas for managing purged water and expendable sampling materials.

8.1.4 In accordance with SOP-1.08, decontaminate all sampling equipment before taking the first sample and between sampling intervals.

8.2 Sampling

8.2.1 Purge wells before sampling, as specified in SOP-6.01. Ensure that the wells were not pumped dry and that flow is at a rate that does not cause turbulence in the formation.

8.2.2 Perform other sampling tasks as specified in SOP-6.02 before collecting volatile samples.

8.2.3 Determine if there is residual chlorine in the water to be sampled;although residual chlorine is not likely to occur in groundwater because chlorine has not been added. If there is residual chlorine, treat the sample vials before sample collection with sodium thiosulfate or other appropriate material according to the site-specific Sampling and Analysis Plan (SAP).

8.2.4 Determine contamination levels of wells. Monitoring/characterization wells should be sampled by moving from the least to the most contaminated areas to reduce the possibility for cross-contamination.

8.2.5 Collect VOC samples using the most appropriate sampling mechanism following the site-specific SAP.

8.2.6 If a pump is used for sampling, follow the manufacturer's operating instructions for that specific pump. If a syringe is used, follow these steps:

8.2.6.1 If necessary, evacuate the syringe. Lower the sampling device to just below the well screen.

8.2.6.2 Remove the constriction from the device and allow the syringe to fill with sample by applying slight suction.

8.2.6.3 Bring unit to the surface. If necessary, transfer the sample to Teflon septum vials.

8.2.7 If a bailer is used, follow these guidelines:

8.2.7.1 Spread a new plastic sheet on the ground around the wellhead, inside a secure, delineated zone, to establish a clean working area.

8.2.7.2 Decontaminate all sampling equipment per SOP-1.08.

8.2.7.3 Cool the bailer and sample containers before use to approximately the groundwater temperature. Avoid exposing them to direct sunlight.

8.2.7.4 Lower the Teflon closed-top, bottom-charging bailer into the water column slowly, and note its depth below ground level. Stop when the bailer reaches the well's screened interval.

8.2.7.5 Slowly recover the bailer; collect the cable either onto a reel or into a cleaned stainless steel bucket.

8.2.7.6 Use the bailer's bottom discharge tube (Teflon) to fill the 40-ml vials by slow drainage from the tube.

8.2.7.7 Repeat steps in Sections 6.2.7.3 through 6.2.7.6 as often as necessary to acquire sufficient sample quantities.

8.2.8 The septum vials (40-ml) should be completely filled to prevent volatilization, and extreme caution should be exercised when filling a vial to avoid any turbulence that could also produce volatilization. The sample should be carefully poured down the side of the vial to minimize turbulence. As a rule, it is best to gently pour the last few drops into the vial so that surface tension holds the water in a "convex meniscus." The cap is then applied and some overflow is lost, but air space in the vial is eliminated. After capping, turn the vial over and tap it to check for gas bubbles. If any gas bubbles are

present, repeat the procedure only once. If a second try is required, use a new sample vial.

8.2.9 When water samples for purgeable organic compounds are collected, duplicate samples should always be collected from each location. Water samples to be analyzed for purgeable organic compounds should be stored in 40-ml septum vials with a screw cap and a Teflon silicone disk in the cap to prevent contamination of the sample by the cap. The disks should be placed in the caps (with Teflon side in contact with the sample) by the sample container's vendor before the beginning of the sampling program.

8.2.10 After each use, the sampling equipment must be decontaminated in accordance with SOP-1.08.

8.2.11 A sampling blank should be acquired at each monitoring/characteriztion well to test the decontamination procedure's efficiency.

8.3 Documentation

8.3.1 Follow SOP-1.04 for documenting all pertinent information (such as weather conditions, deviations, and turbidity of sample) in the field notebooks or Daily Activity Log forms. All labels will be completed and affixed as indicated in SOP-1.04.

8.3.2 Document the calibration of field instruments as specified in SOP-6.02.

8.3.3 Document well purging as specified in SOP-6.01.

8.4 Postoperation Activities

8.4.1 Decontaminate sampling equipment as instructed in SOP-1.08.

8.4.2 Make sure all wells are properly labeled and that the location ID is readily visible on the protective casing.

8.4.3 Prepare samples and transport them to the SMO according to SOP-1.02, SOP-1.03, and SOP-1.04.

Note The FTL will contact the SMO to ensure that samples arrive safely and the instructions for sample analyses are clearly understood. Record this information in the field notebook or on the Daily Activity Log form (Attachment E in SOP-1.04).

8.5 Perform Lessons Learned

During the performance of work, **ER Project personnel** shall identify, document, and submit lessons learned, as appropriate in accordance with

QP-3.2, Lessons Learned, located at http://erinternal.lanl.gov/home_links/Library_proc.htm.

9.0 REFERENCES

ER Project personnel should become familiar with the contents of the following documents to properly implement this QP.

- ER Project Quality Management Plan located at http://erinternal.lanl.gov/home_links/Library_proc.htm
- QP-2.2, Personnel Orientation and Training
- QP-4.2, Standard Operating Procedure Development
- QP-4.4, Record Transmittal to the Records Processing Facility
- SOP-1.02, Sample Containers and Preservation
- SOP-1.03, Handling, Packaging, and Shipping of Samples
- SOP-1.04, Sample Control and Field Documentation
- SOP-1.08, Field Decontamination of Drilling and Sampling Equipment
- SOP-6.01, Purging of Well for Representative Sampling of Groundwater
- SOP-6.02, Field Analytical Measurements of Groundwater Samples
- Barcelona, M. J., J. A. Helfrich, E. E. Garske, and J. P. Gibb, 1984. "A Laboratory Evaluation of Groundwater Sampling Mechanisms," in *Groundwater Monitoring Review*, Spring 1984, pp. 32–41.
- Bennett, Robert Co., "Operation Manual for the Bennett Sampling Pump," (Amarillo, TX, 1988).
- EPA, "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," (OSWER, Washington, D.C., 1986).
- EPA Region 4, "Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual," (Environmental Services Division, Athens, GA, 1991).
- Nielsen, D. M. and G. L. Yeates, "A Comparison of Sampling Mechanisms Available for Small-Diameter Groundwater Monitoring Wells," *Groundwater Monitoring Review*, Spring 1985, pp. 83–99.

10.0 RECORDS

The **FTL** is responsible for submitting the following records (processed in accordance with QP-4.4, Record Transmittal to the Records Processing Facility) to the Records Processing.

10.1 Daily Activity Log forms (Attachment E in SOP-1.04) or field notebooks, including any deviation(s) or other pertinent information

10.2 Sample Collection Logs (Attachment B in SOP-1.04), including any deviation or other pertinent information.

10.3 Water Quality Sampling Records (Attachment B in SOP-6.01)

10.4 Water Quality Stabilization Records (Attachment B in SOP-6.02)

11.0 ATTACHMENTS

Attachment A: Equipment and Supplies Checklist for Sampling Volatile Organics (1 page) located at http://erinternal.lanl.gov/Quality/user/forms.asp.

Equipment and Supplies Checklist for Sampling Volatile Organics

- ☐ Teflon stainless steel bladder pump and its manufacturer's operating manual
- ☐ Teflon stainless steel gear-driven submersible pump and its manufacturer's operating manual
- ☐ Syringe sampler (stainless steel, Teflon, or glass) and its manufacturer's operating manual
- ☐ Teflon bailer (closed-top, bottom-charging) and its manufacturer's operating manual
- ☐ Teflon or other chemically inert tubing
- ☐ Fittings for pump
- ☐ 40-ml amber glass vials; Teflon-lined septa
- ☐ Hach field kit for chlorine (optional)
- ☐ Na_2SO_4 crystals, if appropriate
- ☐ HCl (concentrated)
- ☐ Foam sleeves, coolers, and Blue Ice (or equivalent)
- ☐ Stainless steel cable, reel, and tripod (if needed)
- ☐ Air compressor or bottled nitrogen
- ☐ Plastic sheet
- ☐ Daily Activity Log forms or field notebook
- ☐ Chain-of-Custody/Request for Analysis Forms
- ☐ Sample Collection Logs
- ☐ Water Quality Sampling Record form(s)
- ☐ Water Quality Stabilization Record form(s)
- ☐ Variance logs
- ☐ Custody seals
- ☐ Sample labels
- ☐ Any PPE listed or required in the SSHASP

Any additional supplies listed in associated procedures, as needed